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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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EXAMINER

TOLEDO, FERNANDO L

ART UNIT	PAPER NUMBER
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2823

DATE MAILED: 02/14/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/688,817

Applicant(s)

SHAN, ET AL.

Examiner

Fernando Toledo

Art Unit

2823

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 17 October 2000.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-24 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-24 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 17 October 2000 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☒ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 2.
- 4) ☒ Interview Summary (PTO-413) Paper No(s) _____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____

DETAILED ACTION

Specification

1. In the claims:

Claim 22 after layer, replace --bing-- with "being".

2. The title of the invention is not descriptive. A new title is required that is clearly indicative of the invention to which the claims are directed.

Double Patenting

3. The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. See *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); and, *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent is shown to be commonly owned with this application. See 37 CFR 1.130(b).

Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

4. Claims 1 – 21 and 24 are rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1 – 24 of U.S. Patent No. 6,140,228. Although the conflicting claims are not identical, they are not patentably distinct from each other because the U. S. patent 6,140,228 claims a specific range of temperature and power while the present application claims "that the deposition of a second amount of metal on the seed layer at a substrate temperature and power" with no specific temperature or power.

However, the temperature and power claimed in U. S. patent 6,140,228 encompass the claimed temperature and power of the present application.

Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to deposit a second amount of metal on the seed layer at a substrate temperature and power, since the U. S. patent 6,140,228 deposits the same second amount of metal at a defined temperature and defined power.

5. Claims 22 and 23 are rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1 – 24 of U.S. Patent No. 6,140,228 in view of Xu et al. U. S. patent 6,217,721 B1. The U. S. patent 6,140,228 does not claim the formation of TiAl_3 .

However, Xu et al. in the U. S. patent 6,217,721 B1 discloses forming a plug in a high aspect ratio hole with aluminum and a Ti or Ti compound as a wetting or barrier layer and that the combination of Al with Ti will form TiAl_3 if proper steps are not taken.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to form TiAl_3 in the U. S. patent 6,140,228; because as taught by Xu, TiAl_3 can be readily formed with Al and Ti if proper steps are not taken.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or on an international application by another who has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371(c) of this title before the invention thereof by the applicant for patent.

The changes made to 35 U.S.C. 102(e) by the American Inventors Protection Act of 1999 (AIPA) do not apply to the examination of this application as the application being examined was not (1) filed on or after November 29, 2000, or (2) voluntarily published under 35 U.S.C. 122(b). Therefore, this application is examined under 35 U.S.C. 102(e) prior to the amendment by the AIPA (pre-AIPA 35 U.S.C. 102(e)).

6. Claims 1 – 5 and 7 – 24 are rejected under 35 U.S.C. 102(e) as being anticipated by Xu et al. (U. S. patent 6,217,721 B1).

In re claims 1, 21 – 24 Xu in the U. S. patent 6,217,721 B1; figures 1 – 22 and related text discloses i) depositing a seed layer of the metal on a first substrate surface, the seed layer being sufficient to cover the first substrate surface (column 20); ii) depositing a second amount of metal on the seed layer at a substrate temperature and power that are sufficient to (i) inhibit formation of filamentous metal phases (i.e. TiAl_3) having a resistivity greater than that of the metal and (ii) provide a metal diffusion rate and a metal deposition rate sufficient to inhibit void formation in an opening having an aspect ratio of at least 2.0 (columns 3, 23 and 24); iii) depositing a third amount of metal on the second amount of metal (figures 16 and 17).

In re claim 2, Xu discloses wherein the substrate further comprises a hole (figure 8).

In re claim 3, Xu discloses before step i) forming a barrier/liner layer in the via channel (column 12, figure 8).

In re claim 4, Xu discloses wherein step ii) is conducted at a substrate temperature and a power sufficient to inhibit formation of filamentous metal phases (i.e.

TiAl₃) with the barrier/liner layer, having resistivity greater than that of the metal (column 23).

In re claim 5, Xu discloses wherein the second amount of metal is deposited at a rate of about 5 to 30 Å/sec. (figure 15).

In re claim 7, Xu discloses wherein the second amount of metal is deposited at a substrate temperature of 300 to 420°C (column 24).

In re claim 8, Xu discloses wherein the second amount of metal is deposited to form a layer of 400 to 3,000 Å thick (figure 15).

In re claim 9, Xu discloses wherein the metal is aluminum (column 24).

In re claim 10, Xu discloses depositing the seed layer at a power of 9,000W (i.e. 9kW) (column 15).

In re claim 11, Xu discloses wherein the seed layer is deposited at a pressure of 1 to 3 mTorr (column 15).

In re claim 12, Xu discloses wherein the seed layer is deposited at a rate of 100 to 200 Å/sec (column 20).

In re claim 13, Xu discloses wherein the seed layer is deposited to form a layer of 500 to 4,000 Å (column 20).

In re claim 14, Xu discloses wherein heating of the substrate in the second step is by backside gas flow (column 11).

In re claim 15, Xu discloses wherein the gas is argon (column 11).

In re claim 16, Xu discloses wherein the opening has an aspect ratio of at least 3:1 (column 2).

In re claim 17, Xu discloses wherein the second amount of metal deposited is sufficient to fill the opening (figure 8).

In re claim 18, Xu discloses further including forming a liner/wetting layer is deposited in the opening before step i) (column 12).

In re claim 19, Xu discloses wherein the second amount of metal is deposited at a power of 100 to 800 W (column 20).

In re claim 20, Xu discloses wherein the opening has an aspect ratio of 2.5 (column 2).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

7. Claim 6 is rejected under 35 U.S.C. 103(a) as being unpatentable over Xu as applied to claims 1 – 5 and 7 – 24 above.

Xu teaches that the second amount of metal is deposited at a pressure of 0.5 to 2 mTorr (column 24). Xu does not teach wherein the pressure is 4 to 6 mTorr.

However, it would have been obvious to one having ordinary skill in the art at the time the invention was made to deposit the second amount of metal at 4 to 6 mTorr, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. *In re Aller*, 105 USPQ 233. Note that the specification contains no disclosure of either the

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critical nature of the claimed pressure or any unexpected results arising therefrom. Where patentability is said to be based upon particular chosen pressure or upon another variable recited in a claim, the Applicant must show that the chosen pressure are critical. In re Woodruf, 919 F.2d 1575, 1578, 16 USPQ2d 1934, 1936 (Fed. Cir. 1990).

Conclusion


8. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Fernando Toledo whose telephone number is (703) 305-0567. The examiner can normally be reached on Monday – Friday, 8am – 4pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Wael Fahmy can be reached on (703) 308-4918. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 308-7722 for regular communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.

	Fernando Toledo Patent Examiner Art Unit 2823
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ft
January 24, 2002


CARL WHITEHEAD, JR.
SUPERVISORY PATENT EXAMINER
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